# South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

## Site details

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| **Site Code** | **SN0262** |
| **Address** | Land North of Church Road, Woodton, South Norfolk, 629339, 294692 |
| **Area** | 1.045ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |

## Sources of flood risk

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| **Location of the site within the catchment** | The site is located in the Broome Beck Catchment, North of Woodton. The Broome Beck flows from its source in Bedingham, east, past Woodton, and joins the River Waveney at Broome. |
| **Existing drainage features** | The site is located approximately 0.2km north-west of Woodton Stream, a tributary of the Broom Beck. Apart from those specified, there are no additional watercourses within the site boundary or near the site. |
| **Fluvial** | **The proportion of site at risk (Environment Agency's Flood Map for Planning Flood Zones):**<br>**FZ3b –** 0%<br>**FZ3a**- 0%<br>**FZ2 –**0%<br>**FZ1 –** 100%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br><br>**Available data:**<br>The Environment Agency's (EA) Flood Map for Planning has been used within this assessment.<br><br>**Flood characteristics:**<br>The EA's Flood Map for Planning shows the site is not located in Flood Zone 2 and 3. |
| **Surface Water** | **Proportion of site at risk (Environment Agency's RoFSW dataset):**<br>**3.3% AEP** – 8.20%<br>Max depth – 0.30 – 0.60m<br>Max velocity – 0.25 – 0.50m/s<br>**1% AEP** – 8.90%<br>Max depth – 0.30 – 0.60m<br>Max velocity – 0.25 – 0.50m/s<br>**0.1% AEP** – 15.4%<br>Max depth – 0.30 – 0.60m<br>Max velocity – 0.50 – 1.00m/s<br><br>*The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a greater Annual Exceedance Probability (e.g. 1% AEP %includes the 3.3% AEP %)* |

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| | **Description of surface water flow paths:**<br>The site is affected by surface water flooding in the 3.3%, 1% and 0.1% AEP event. In the 3.3% AEP and 1% AEP surface water events, water ponds in the lower lying south-east corner of the site. In the 0.1% AEP event, a small surface water flow forms between Woodton Stream and the south-east corner of the site. Depths are largely between 0.01-0.15m along the flow path, with velocity of up to 1.00–2.00m/s. The area of ponding in the south-east corner of the site reaches depths of 0.30–0.60m. The hazard rating for the majority of the flow is 'very low hazard'. The centre of the ponding is mostly classed as 'danger for some' with a smaller area of 'danger for most'.<br><br>In the 0.1% AEP event, several significant surface water flow paths are present in the vicinity of the site- these are discussed further in 'Access and Egress', below. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |
| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The entire site has a <25% susceptibility to groundwater flood emergence.<br>The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located in a postcode with no recorded historic sewer flooding, according to Anglian Water's DG5 Register for Greater Norwich. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site.<br>Norfolk County Council's historic flooding records also do not show any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | This site is not protected by any formal flood defences. |
| **Residual risk** | There is no residual risk to the site from flood risk management structures. |
| **Emergency planning** | |
| **Flood warning** | The site is not located in an Environment Agency Flood Alert or Flood Warning area. |
| **Access and egress** | The site could be accessed via Church Road on the southern border or Norwich Road on the eastern border of the site.<br>Whilst the western side of the site is not at significant risk from surface water, the eastern side of the site, along with Church Road to the south and Norwich Road to the east are likely to be impacted in the 3.3%, 1% and 0.1% AEP modelled surface water events. In the 0.1% event, surface water ponding in the southeast corner of the site could reach a maximum depth of 0.60m.<br>The site, and surrounding roads, are unaffected by fluvial and coastal flooding according to the Environment Agency's Flood Map for Planning.<br>Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event and fluvial events. Ideally, the access route should be situated 300mm above the designed flood level. Raising of access routes must not impact on surface water flow routes.<br>Consideration should be given to the siting of access points with respect to areas of flood risk. |
| **Dry Islands** | The site is not located on a dry island. |
| **Climate change** | |

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| **Implications for the site** | • Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.<br>• The site is not at risk of fluvial flooding in the present day or future scenario.<br>• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% Climate Change upper uplift (for the Broadland Rivers Management Catchment peak flows) event mapping suggests that the site is likely to be at a slight increased risk of surface water flooding in future, with the area of ponding in the south-east corner of the site increasing in diameter by approximately 10m. Risk to the Church Road and Norwich Road also increases slightly in this climate change scenario.<br>• Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA. |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br>• Geology at the site consists of:<br>  ○ Bedrock- Neogene to Quaternary Rocks (undifferentiated)- Gravel, Sand, Silt and Clay<br>  ○ Superficial- Till-Diamicton<br>• Soils at the site consist of:<br>  ○ Slightly acid loamy and clayey soils with impeded drainage<br>**SuDS**<br>• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.<br>• BGS data indicates that the underlying geology are conglomerates, gravel, silt, sand and muds which are likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.<br>• The site is not located within a historic landfill site.<br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.<br>• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |
| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.<br>• Opportunities to incorporate source control techniques such as green roofs, blue/green corridors, permeable surfaces and rainwater harvesting must be considered in the design of the site. |
| **NPPF and planning implications** | |
| **Exception Test requirements** | • The Local Authority will need to confirm that the sequential test has been carried out. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'. |

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| | • As the site contains an area at risk of surface water flooding, the Exception Test needs to be applied.<br>• The Exception Test will be passed if the area at risk of surface water flooding in the southeast corner of the site is left undeveloped and instead incorporated as amenity greenspace. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br>• At the planning application stage, a site-specific Flood Risk Assessment will be required as the proposed development site is more than 1 hectare in area and there is a risk of surface water flooding.<br>• All sources of flooding, particularly the risk of fluvial and surface water should be considered as part of a site-specific flood risk assessment.<br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework, Flood Risk and Coastal Change Planning Practice Guidance, South Norfolk Council's Local Plan policies, and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.<br>• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.<br><br>**Guidance for site design and making development safe:**<br>• Safe access and egress will need to be demonstrated in the 1 % AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level. Raising of access routes must not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.<br>• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.<br>• Areas at risk from surface water flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. Integrated flood risk management and sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and help to ensure that overland flows do not overwhelm future sustainable drainage features.<br>• The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water). |

## Key messages

The development is likely to be able to proceed if:

- Safe access and egress can be demonstrated in the 1% AEP surface water event.
- A site-specific FRA demonstrates that the site is not at an increased risk of surface water flooding in the future, that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties, and how the natural flood storage provided by the pre-developed site is preserved.

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. |
| **Climate change** | For fluvial flood risk, climate change data was not available for this site. For surface water risk, a 1% AEP +40% scenario has been considered, which represents the Broadland Rivers Management Catchment for the 2070s. |
| **Fluvial depth, velocity and hazard mapping** | N/A |
| **Surface Water** | The Environment Agency's Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding. |

# South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

## Site details

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| **Site Code** | **SN0274REVA** |
| **Address** | The Street, Gillingham, South Norfolk, 40862 91986 |
| **Area** | 1.24ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |

## Sources of flood risk

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| **Location of the site within the catchment** | The site is located in the River Waveney Catchment, between Ellingham Mill and Burgh St.Peter. The River Waveney flows from its source in the Regrave and Lopham Fen National Nature Reserve, through the towns of Harleston, Diss, Bungay and Beccles, and joins the River Yare before it reaches the sea at Great Yarmouth. |
| **Existing drainage features** | The site is located approximately 0.9km north-east of the River Waveney. The Environment Agency states that the reach section in which the site is located near is heavily modified, having undergone channel straightening and deepening over the years. Online imagery suggests there are drainage ditches behind the site that direct water to the main river channel. Apart from those specified, there are no additional watercourses within the site boundary or near the site. |
| **Fluvial** | **The proportion of site at risk:**<br>**FZ3 –** 57.8%<br>**FZ2 –** 85.7%<br>**FZ1 –** 14.3%<br><br>**Modelling**<br><br>**5% AEP -** <1%<br>**1% AEP -** <1%<br>**0.1% AEP -** <1%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br>**Available data:**<br>Site-specific modelling for the site undertaken was based on the existing Environment Agency Lower Waveney model, 2013; as rerun 2017 by JBA Consulting for the Environment Agency. The existing model is predominantly a 1D Flood Modeller model utilising extended cross-sections and, in some area's reservoir units, to represent the flood plain. Flood Modeller and TUFLOW software was used for the existing Lower Waveney model and was retained for this study. Two 2D domains covering relevant portions of the flood plain on the left bank of the River Waveney were added to the model.<br>**Flood characteristics:**<br><br>In all three modelled fluvial scenarios, flood water flows along The Street adjacent the southern border of the site, crossing slightly into the site. |

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| | In all scenarios, depths in the flow are mostly between 0.3-0.6m, deeper to the west. Velocities in the 5% AEP scenario are up to 1.7m/s, rising to 2.2m/s in the 1% and 0.1% AEP scenarios. In all scenarios, the maximum hazard present in the flow is 'danger for all'. Whilst the site itself is not at significant risk, this flow is likely to impact safe access/egress to the site. |
| **Coastal and Tidal** | **Modelling**<br><br>**1% AEP -** 0%<br>**0.5% AEP -** 0%<br>**0.1% AEP –** 0%<br><br>**Available data:**<br>Site-specific modelling for the site undertaken was based on the existing Environment Agency Lower Waveney model, 2013, as rerun 2017 by JBA Consulting for the Environment Agency. The existing model is predominantly a 1D Flood Modeller model utilising extended cross-sections and, in some area's reservoir units, to represent the flood plain. Flood Modeller and TUFLOW software was used for the existing Lower Waveney model and was retained for this study. Two 2D domains covering relevant portions of the flood plain on the left bank of the River Waveney were added to the model.<br><br>**Flood characteristics:**<br><br>The site is not shown to be at significant risk of tidal flooding in all three modelled scenarios. Whilst there are uncertainties due to high-level nature of modelling undertaken for this assessment, this is believed to be a conservative estimate of risk. |
| **Surface Water** | **Proportion of site at risk (RoFfSW):**<br>**3.3% AEP** – 7.4%<br>Max depth – 0.3-0.6m<br>Max velocity – 0.5-1.0m/s<br>**1% AEP** – 10.9%<br>Max depth – 0.3-0.6m<br>Max velocity – 0.5-1.0m/s<br>**0.1% AEP** – 17%<br>Max depth – 0.6-0.9m<br>Max velocity – 0.5-1.0m/s<br><br>*The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)*<br><br>**Description of surface water flow paths:**<br><br>The site is predicted to be affected by surface water in all modelled scenarios. In the 3.3% surface water event, surface water ponds in the topographic depression in the southern corner of the site. Flood depths are largely below 0.3m, deeper in the centre of the ponding. Velocities are largely below 0.25m/s with isolated areas where velocities reach up to 0.5-1.0m/s. Hazard across most of the flooded area is 'Caution'.<br>In the 1% AEP event the area of predicted flooding expands, and feeds into a surface water flow along The Street. A small surface water flow also forms in the east of the site, toward the area of ponding. Flood depths are 0.3-0.6m in the centre of the ponding and below 0.3m across the rest of the flooded area. Velocities are mostly below 0.25m/s with small areas where velocities reach up to 0.5-1.0m/s. Hazard is 'danger for some' across most of the flooded area, rising to 'danger for most' in the flow along the southern border.<br>In the 0.1% AEP event, a predicted surface water flow covers the east of the sites, flowing form the north-east corner to the southern corner, joining the flow along The Street. Depths are greatest in the south corner, 0.6-0.9m adjacent The Street and 0.3-0.6m across the rest of the southern corner. The rest of the flooded area has depths below 0.3m. Velocities are greatest in the centre of the flow, 0.5-1.0m/s. Hazard is greatest in the southern corner with a rating of 'danger for most' and a rating of 'caution' across the rest of the flooded area. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |

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| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The entire site has a >=25%-<50% susceptibility to groundwater flood emergence.<br>The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located in a postcode with no recorded historic sewer flooding. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | This site is not protected by any formal flood defences. |
| **Residual risk** | There is no residual risk to the site from flood risk management structures. |
| **Emergency planning** | |
| **Flood warning** | The site is not located in an Environment Agency Flood Alert or Flood Warning area. |
| **Access and egress** | The site is accessed via The Street on the southern border of the site.<br>Whilst The Street is not at significant risk from surface water, Old Yarmouth Road to the north and Geldeston Road to the west are likely to be significantly impacted in all modelled surface water events.<br>In all modelled fluvial events, a significant floodwater flow forms along The Street and is likely to severely impede access to the site.<br>Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event and fluvial events. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must not impact on surface water flow routes.<br>Consideration should be given to the siting of access points with respect to areas of flood risk. A Flood Warning and Evacuation plan should be in place for the site. Alternatively, risk could be managed by inclusion of a higher refuge and a flood response plan that meets the requirements of the Local Council and their Emergency Planner, considering the likely warning time and duration of flooding. |
| **Climate change** | |
| **Implications for the site** | • Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.<br>• The central and higher climate change scenarios have been modelled as part of this assessment. Modelling suggests that the site will not be at significantly greater fluvial risk in the future, even during the 0.1% AEP event in the higher central scenario, although the flooding on The Street will increase in depth and velocity.<br>• In terms of tidal risk, the site is sensitive to the impacts of climate change. In the 0.1% AEP event in the Higher central scenario, 9% of the site is flooded and in the Upper End scenario 27% of the site is affected. In both the higher Central and Upper end Scenarios, water does not affect the site in the 1% and 0.5% AEP events, however The Street adjacent the site is affected.<br>• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% event mapping suggests that the site is unlikely to be at increased risk of surface water flooding in future, although there remains a significant risk to the area around the site. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition. |

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| | • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA. |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br>• Geology at the site consists of:<br>  ○ Bedrock- Crag Group- Sand.<br>  ○ Superficial- Lowestoft Formation- Diamicton and Lowestoft Formation- Sand and Gravel.<br>• Soils at the site consist of:<br>  ○ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.<br>**SuDS**<br>• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.<br>• BGS data indicates that the underlying geology is sand which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.<br>• The site is not located within a historic landfill site.<br>• Proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 3 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the River Waveney may be susceptible to surcharging due to water levels in the River Waveney. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.<br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.<br>• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |
| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.<br>• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.<br>• Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. |

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| | • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.<br>• The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows. |
| **NPPF and planning implications** | |
| **Exception Test requirements** | The Local Authority will need to confirm that the sequential test has been carried out. The Sequential Test will need to be passed before the Exception Test is applied.<br>The NPPF classifies residential development as 'More Vulnerable'. As part of the site is in Flood Zone 2, the Exception Test is required for the site. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br>• At the planning application stage, a site-specific Flood Risk Assessment will be required as the proposed development site is in Flood Zone 2.<br>• All sources of flooding, particularly the risk of fluvial, tidal, and surface water should be considered as part of a site-specific flood risk assessment. Detailed modelling should be undertaken to confirm the likely impact of fluvial and tidal flooding on the site both in the present-day and future.<br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance, Norwich City Council's Local Plan policies, and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.<br>• Consultation with the Local Authority, Lead Local Flood Authority and the Environment Agency should be undertaken at an early stage.<br>• The development should be designed to ensure that mitigation measures are in place to ensure the development does not flood, or that ground level space is used for less vulnerable parts of the development.<br>**Guidance for site design and making development safe:**<br>• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).<br>• Flood resilient design would be essential should dwellings be proposed in areas shown to be at risk by detailed modelling. Habitable floor levels must be above the 1% AEP flood level taking into account climate change (upper end scenario) with an allowance for freeboard.<br>• Safe access and egress will need to be demonstrated in the 1 % AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk<br>• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.<br>• Areas at risk from surface water flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. Integrated flood risk management and sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will |

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| | determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.<br><br>• The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water). |

## Key messages

The site may be at risk of tidal flooding in future considering climate change. Development may be able to proceed if:

- Detailed modelling undertaken as part of the site-specific flood risk assessment demonstrates that the site is not at significant risk in future.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with habitable floor levels above the fluvial design flood event (1% AEP) taking into account climate change.
- If flood mitigation measures are implemented then they are tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).
- Safe access and egress can be demonstrated in the 1% AEP surface water, tidal, and fluvial events, or an appropriate Flood Warning and Evacuation plan based on a policy of shelter-in-situ is agreed with the Local Councils' Emergency Planner.

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. |
| **Climate change** | Climate change allowances (for the 2080s) were modelled as part of Level 2 SFRA. This included Central (+11%), Higher central (+20%). For surface water a +40% scenario has been considered. |
| **Fluvial depth, velocity and hazard mapping** | Site-specific modelling for the site undertaken was based on the existing Environment Agency Lower Waveney model, 2013; as rerun 2017 by JBA Consulting for the Environment Agency. The existing model is predominantly a 1D Flood Modeller model utilising extended cross-sections and, in some area's reservoir units, to represent the flood plain. Flood Modeller and TUFLOW software was used for the existing Lower Waveney model and was retained for this study. Two 2D domains covering relevant portions of the flood plain on the left bank of the River Waveney were added to the model. |
| **Surface Water** | The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding. |
| **Surface water depth, velocity and hazard mapping** | The surface water depth and hazard mapping is taken Environment Agency's Risk of Flooding from Surface Water mapping. |

# South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

## Site details

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| **Site Code** | **SN0274REVB** |
| **Address** | The Street, Gillingham, South Norfolk, 40783 92035 |
| **Area** | 0.90ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |

## Sources of flood risk

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| **Location of the site within the catchment** | The site is located in the River Waveney Catchment, between Ellingham Mill and Burgh St.Peter. The River Waveney flows from its source in the Regrave and Lopham Fen National Nature Reserve, through the towns of Harleston, Diss, Bungay and Beccles, and joins the River Yare before it reaches the sea at Great Yarmouth. |
| **Existing drainage features** | The site is located approximately 0.9km north-east of the River Waveney. The Environment Agency states that the reach section in which the site is located near is heavily modified, having undergone channel straightening and deepening over the years. Online imagery suggests there are a number of drainage ditches present on the site. Apart from those specified, there are no additional watercourses within the site boundary or near the site. |
| **Fluvial** | **The proportion of site at risk:**<br>**FZ3 –** 57.1%<br>**FZ2 –** 60.8%<br>**FZ1 –** 39.2%<br><br>**Modelling:**<br>**5% AEP -** <1%<br>**1% AEP -** <1%<br>**0.1% AEP -** <1%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br><br>**Available data:**<br>Site-specific modelling for the site undertaken was based on the existing Environment Agency Lower Waveney model, 2013; as rerun 2017 by JBA Consulting for the Environment Agency. The existing model is predominantly a 1D Flood Modeller model utilising extended cross-sections and, in some area's reservoir units, to represent the flood plain. Flood Modeller and TUFLOW software was used for the existing Lower Waveney model and was retained for this study. Two 2D domains covering relevant portions of the flood plain on the left bank of the River Waveney were added to the model.<br><br>**Flood characteristics:**<br>In all three modelled fluvial scenarios, flood water flows along The Street adjacent the southern border of the site, crossing slightly into the site. |

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| | In all scenarios, depths in the flow are mostly between 0.3-0.6m, deeper to the west. Velocities in the 5% AEP scenario are up to 1.7m/s, rising to 2.2m/s in the 1% and 0.1% AEP scenarios. In all scenarios, the maximum hazard present in the flow is 'danger for all'. Whilst the site itself is not at significant risk, this flow is likely to impact safe access/egress to the site. |
| **Coastal and Tidal** | **Modelling:**<br>**1% AEP -** 0%<br>**0.5% AEP -** 0%<br>**0.1% AEP -** <1%<br><br>**Available data:**<br>Site-specific modelling for the site undertaken was based on the existing Environment Agency Lower Waveney model, 2013; as rerun 2017 by JBA Consulting for the Environment Agency. The existing model is predominantly a 1D Flood Modeller model utilising extended cross-sections and, in some area's reservoir units, to represent the flood plain. Flood Modeller and TUFLOW software was used for the existing Lower Waveney model and was retained for this study. Two 2D domains covering relevant portions of the flood plain on the left bank of the River Waveney were added to the model.<br><br>**Flood characteristics:**<br>The site is not shown to be at risk in the 1% or 0.5% AEP tidal event. In the 0.1% AEP tidal event, flood water just reaches the ditch at southern corner of the site. Depths are below 10cm, and the majority of the site remains unaffected. |
| **Surface Water** | **Proportion of site at risk (RoFfSW):**<br>**3.3% AEP** – 0%<br>Max depth – N/A<br>Max velocity – N/A<br>**1% AEP** – 0%<br>Max depth – N/A<br>Max velocity – N/A<br>**0.1% AEP** – 0%<br>Max depth – N/A<br>Max velocity – N/A<br><br>*The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)*<br><br>**Description of surface water flow paths:**<br>The site is not affected by surface water flooding in the 0.1% AEP event. In the 0.1% AEP surface water event, a small surface water flow forms along The Street on the southern boundary of the site. Depths are between 0.3-0.6m, with velocity below 0.25m/s. The hazard rating for the flow is 'danger for some'.<br><br>Several significant surface water flow paths are present in the vicinity of the site- these are discussed further in 'Access and Egress', below. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |
| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The entire site has a <25% susceptibility to groundwater flood emergence.<br>The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located in a postcode with no recorded historic sewer flooding. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | This site is not protected by any formal flood defences. |

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| **Residual risk** | There is no residual risk to the site from flood risk management structures. |
| **Emergency planning** | |
| **Flood warning** | The site is not located in an Environment Agency Flood Alert or Flood Warning area. |
| **Access and egress** | The site is accessed via The Street on the southern border of the site.<br><br>Whilst the site is not at significant risk from surface water, Old Yarmouth Road to the north and Geldeston Road to the west are likely to be significantly impacted in all modelled surface water events.<br><br>In all modelled fluvial events, a significant floodwater flow forms along The Street and is likely to severely impede access to the site.<br><br>Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event and fluvial events. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must not impact on surface water flow routes.<br><br>Consideration should be given to the siting of access points with respect to areas of flood risk. A Flood Warning and Evacuation plan should be in place for the site. Alternatively, risk could be managed by inclusion of a higher refuge and a flood response plan that meets the requirements of the Local Council and their Emergency Planner, considering the likely warning time and duration of flooding. |
| **Dry Islands** | The site is not located on a dry island. |
| **Climate change** | |
| **Implications for the site** | • Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.<br><br>• The central and higher climate change scenarios have been modelled as part of this assessment. Modelling suggests that the site will not be at significantly greater risk in the future, even during the 0.1% AEP event in the higher central scenario, although the flooding on The Street will increase in depth and velocity.<br><br>• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% event mapping suggests that the site is unlikely to be at increased risk of surface water flooding in future, although there remains a significant risk to the area around the site.<br><br>• Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA. |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br><br>• Geology at the site consists of:<br>  ○ Bedrock- Crag Group-Sand.<br>  ○ Superficial- Lowestoft Formation- Clay and Silt.<br>• Soils at the site consist of:<br>  ○ Slightly acid loamy and clayey soils with impeded drainage<br><br>**SuDS**<br><br>• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site. |

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| | • BGS data indicates that the underlying geology is sand which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.<br>• The site is not located within a historic landfill site.<br>• Proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 3 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the River Waveney may be susceptible to surcharging due to water levels in the River Waveney. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.<br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.<br>• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |
| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.<br>• Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. |
| **NPPF and planning implications** | |
| **Exception Test requirements** | The Local Authority will need to confirm that the sequential test has been carried out. The Sequential Test will need to be passed before the Exception Test is applied.<br>The NPPF classifies residential development as 'More Vulnerable'. As part of the site is in Flood Zone 2, the Exception Test is required for the site. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br>• At the planning application stage, a site-specific Flood Risk Assessment will be required as the proposed development site is in Flood Zone 2.<br>• All sources of flooding, particularly the risk of fluvial and surface water should be considered as part of a site-specific flood risk assessment.<br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance, Norwich City Council's Local Plan policies, and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.<br>• Consultation with the Local Authority, Lead Local Flood Authority and the Environment Agency should be undertaken at an early stage.<br>• The development should be designed to ensure that mitigation measures are in place to ensure the development does not flood, or that ground level space is used for less vulnerable parts of the development.<br>**Guidance for site design and making development safe:**<br>• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).<br>• Safe access and egress will need to be demonstrated in the 1 % AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. |

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| | Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk<br><br>• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.<br><br>• Areas at risk from surface water flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. Integrated flood risk management and sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.<br><br>• The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water). |

## Key messages

The development is likely to be able to proceed if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with habitable floor levels above the fluvial design flood event (1% AEP) taking into account climate change.
- If flood mitigation measures are implemented then they are tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).
- Safe access and egress can be demonstrated in the 1% AEP surface water and fluvial events, or an appropriate Flood Warning and Evacuation plan based on a policy of shelter-in-situ is agreed with the Local Councils' Emergency Planner.

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. |
| **Climate change** | Climate change allowances (for the 2080s) were modelled as part of Level 2 SFRA. This included Central (+11%), Higher central (+20%). For surface water a +40% scenario has been considered. |
| **Fluvial depth, velocity and hazard mapping** | Site-specific modelling for the site undertaken was based on the existing Environment Agency Lower Waveney model, 2013; as rerun 2017 by JBA Consulting for the Environment Agency. The existing model is predominantly a 1D Flood Modeller model utilising extended cross-sections and, in some area's reservoir units, to represent the flood plain. Flood Modeller and TUFLOW software was used for the existing Lower Waveney model and was retained for this study. Two 2D domains covering relevant portions of the flood plain on the left bank of the River Waveney were added to the model. |
| **Surface Water** | The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding. |

# South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

## Site details

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| **Site Code** | **SN0488** |
| **Address** | School Lane, Little Melton, Norwich, Norfolk TG 16786 07356 |
| **Area** | 1.27ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |

## Sources of flood risk

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| **Location of the site within the catchment** | The site lies within the River Yare catchment towards the north of the South Norfolk District. The west-east trending River Yare is located 880m north of the site and follows the district boundary 1km east of the site. An unnamed watercourse 1km south of the site flows east to meet the River Yare 1.9km southeast of the site. |
| **Existing drainage features** | Local topography shows the northern boundary of the site is at higher relief than the southern edge of the site. High relief 200m west of the site indicates drainage from the site would be in a easterly direction towards the River Yare. |
| **Fluvial** | **The proportion of site at risk:**<br>**FZ3b –** 0%<br>**FZ3a –** 0%<br>**FZ2 –** 0%<br>**FZ1 –** 100%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br><br>**Available data:**<br>The Environment Agency's (EA) Flood Maps for Planning have been used within this assessment.<br><br>**Flood characteristics:**<br>The site is not currently at risk of fluvial flooding. The EA's Flood Maps for Planning show the site is not located within Flood Zone 2 and 3. |
| **Coastal and Tidal** | The site is not at risk of tidal or coastal flooding. |
| **Surface Water** | **Proportion of site at risk (RoFfSW):**<br>**3.3% AEP** – 3%<br>Max depth- 0.3-0.6m<br>Max velocity- 0.0-0.25m/s<br>**1% AEP** – 13%<br>Max depth- 0.9-1.2m<br>Max velocity- 0.5-1.0m/s<br>**0.1% AEP** – 24%<br>Max depth- >1.2m<br>Max velocity- 1.0-2.0m/s |

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| | *The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)*<br><br>**Description of surface water flow paths:**<br>The site is predicted to be at risk of surface water flooding during the 3.3%, 1% and 0.1% AEP events. Flooding is confined to the southern site boundary, with flow paths running adjacent to School Lane along the region of low topography. Surface water flood extents reach 16m, 30m and 38m in from the south of the site during the 3.3%, 1% and 0.1% AEP events respectively. Flow paths start to pond slightly in the southeast corner of the site. The rest of the site is free from surface water flooding due to higher relief.<br><br>During the 3.3% AEP event, predicted maximum flood depths are 0.3-0.6m and maximum velocities are 0.0-0.25m/s along School Lane. This corresponds to a hazard of 'danger for some' in the southeast corner of the site. During the 1% AEP event, flood depths reach a maximum of 0.9-1.2m and velocities 0.5-1.0m/s. This forms a maximum hazard of 'danger for most' in the southeast of the site. Maximum flood depths are >1.2m and maximum velocities 1.0-2.0m/s, resulting in a maximum hazard of 'danger for most' across the southeast corner of the site. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |
| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The entire site has a < 25% susceptibility to groundwater flood emergence.<br>This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located within a postcode where there have been 6 recorded historic sewer flooding incidences. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | The site is not protected by any formal flood defences. |
| **Residual risk** | There is no residual risk to the site from flood risk management structures. |
| **Emergency Planning** | |
| **Flood Warning** | The site is not located in an Environment Agency Flood Warning Area. |
| **Access and egress** | The southwest corner of the site is accessible via a road-access path directly into the site. The site is fully accessible during fluvial flood events by vehicles and on foot. This access point however is not fully accessible during the 3.3%, 1% and 0.1% AEP events due to a surface water flow path along School Lane. During the 3.3% AEP event maximum flood depths are 0.15-0.3m which correlates to a maximum hazard of 'caution' at the southwest of the site. This means the road-access path to the southwest of the site may still be accessible by larger emergency vehicles. This access point remains inaccessible to large emergency vehicles in the 1% and 0.1% AEP event.<br>Since safe access and egress to the site may not be safely possible in all flood events, a Flood Warning and Evacuation Plan should be prepared for the site, with a policy of shelter in situ. |
| **Dry Island** | The site is not located on a dry island. |
| **Implications for the site** | |
| **Climate Change** | • Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. |

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| | • The predicted present day 0.1% AEP surface water flooding extent provides an indication of the likely increase in extent of the more frequent surface water events. There is a significant increase in the extent of flooding between the 1% and 09.1% AEP surface water events, indicating the site is sensitive to increasing runoff as a result of climate change. This would require a detailed Flood Risk Assessment (FRA) to assess the site layout and design. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition.<br><br>• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling.<br><br>• Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.<br><br>• A site-specific FRA, with the most up-do-date climate change allowances, should be undertaken to investigate the implications of climate change on the site. |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br>• Geology at the site consists of:<br>○ Bedrock- Chalk Formation, Newhaven Chalk Formation, Seaford Formation, Culver Chalk, Formation and Portsdown Chalk Formation.<br>○ Superficial- Happisburgh Glacigenic Formation and Lowestoft Formation- Sand and Gravel; and Lowestoft Formation- Diamicton.<br><br>• Soils at the site consist of:<br>○ Slightly acid loamy and clayey soils with impeded drainage<br>**SuDS**<br>• The site is considered to have very low susceptibility to groundwater flooding, this should be confirmed through additional site investigation work. Below ground development such as basements may still be susceptible to groundwater flooding.<br><br>• BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.<br><br>• The site is not located within a historic landfill site.<br><br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br><br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.<br><br>• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |
| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.<br><br>• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. |

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| | • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.<br><br>• Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.<br><br>• The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows. |
| **NPPF and planning implications** | |
| **Exception Test requirements** | The Local Authority will need to confirm that the sequential test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.<br><br>The entire site lies outside of Flood Zone 2 and 3 but as it is predicted to be affected by surface water risk the Exception Test is required. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br><br>• Whilst the site lies entirely outside of Flood Zones 2 and 3, it is recommended that a site-specific Flood Risk Assessment is undertaken to provide evidence that the proposals satisfy the Exception Test due to the surface water flow paths at the south of the site.<br><br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; the Joint Core Strategy as part of the Greater Norwich Development Partnership for Broadland, Norwich and South Norwich; and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.<br><br>• Consultation with the Local Authority and the Lead Local Flood Authority should be undertaken at an early stage.<br><br>**Guidance for site design and making development safe:**<br><br>• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).<br><br>• The development should be designed using a sequential approach. Development should be steered away from areas of surface water flood risk along the southern site boundary, preserving these spaces as green infrastructure.<br><br>• Safe access and egress will need to be demonstrated in the 0.1% AEP event plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.<br><br>• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.<br><br>• On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment.<br><br>• Surface water should be discharged at the pre-development (greenfield) runoff rate which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. An integrated flood risk management and |

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| | sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.<br>• Developers should refer to Norfolk County Council's 'Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning Guidance Document' and the Level 1 SFRA for information on SuDS for guidance on the information required by the LLFA from applicants to enable it to provide responses to planning applications. |

## Key messages

The development is likely to be able to proceed if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development to be steered away from the southern site boundary.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future, and that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA or Anglian Water).
- If flood mitigation measures are implemented, they should be tested to ensure water is not displaced elsewhere.
- Since surface water flow paths occur along School Lane at the southern site boundary, access and egress is not possible during the 1% and 0.1% AEP events. A Flood Warning and Evacuation Plan should therefore be prepared for this site for both present day and considering climate change allowances. Consideration should be given to the siting of safe access and egress routes, and these must not impede surface water flows risk.

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. |
| **Climate change** | No modelled climate change data was available for this site. The 0.1% AEP event surface water mapping from the Risk of Flooding from Surface Water map has been used as a proxy for the impacts of climate change on surface water. |
| **Surface Water** | The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding. |
| **Surface water depth, velocity and hazard mapping** | The surface water depth, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping. |

# South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

## Site details

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| **Site Code** | **SN1015** |
| **Address** | The Street, Hempnall, South Norfolk TM 23903 94666 |
| **Area** | 1.19ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |

## Sources of flood risk

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| **Location of the site within the catchment** | The site is located within the Yare catchment and is located 10km south of the River Yare. The Hempnall Beck runs east-west 45m south of the site before meeting its confluence with the River Tas 4.5km northwest of the site. An unnamed tributary of the Hempnall Beck is located 250m southwest of the site. The Hempnall Beck has not been designated artificial or heavily modified. |
| **Existing drainage features** | The north of the site is of higher relief than the south of the site, meaning the site slopes downwards towards the south. The south-bearing sloped surface of the site indicates drainage is towards the east-west trending Hempnall Beck just south of the site. |
| **Fluvial** | **The proportion of site at risk:**<br>**FZ3b –** 0%<br>**FZ3a –** 0%<br>**FZ2 –** 0%<br>**FZ1 –** 0%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br><br>**Available data:**<br>The Environment Agency's (EA) Flood Maps for Planning have been used within this assessment.<br><br>**Flood characteristics:**<br>The site is not currently at risk of fluvial flooding. The EA's Flood Maps for Planning show the site is not located within Flood Zone 2 and 3. The land 70m south of the site, along the Hempnall Beck, falls within both Flood Zone 2 and 3. This is currently unlikely to affect the site but should be considered when considering the implications of climate change on the site. |
| **Coastal and Tidal** | The site is not at risk of tidal or coastal flooding. |
| **Surface Water** | **Proportion of site at risk (RoFfSW):**<br>**3.3% AEP** – 0%<br>Max depth- N/A<br>Max velocity- N/A<br>**1% AEP** – 1%<br>Max depth - 0.15 - 0.30m<br>Max velocity - 0.00 – 0.25m/s |

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| | **0.1% AEP** – 22%<br>Max depth – 0.30 – 0.60m<br>Max velocity - 0.50 – 1.00m/s<br><br>*The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)*<br><br>**Description of surface water flow paths:**<br>The site is not predicted to be at risk of surface water flooding during the 3.3% AEP event. A surface water pond is predicted to occur during the 1% AEP event 10m from the southern site boundary. This isolated pond is 17m in diameter. Surface water extent is much wider during the 1% AEP event. A much larger pond, of diameter 90m, occurs near the southern site boundary adjacent to The Street. A surface water flow path cuts across the northwest site boundary, entering 18m in from the northwest corner.<br><br>During the 1% AEP event, the predicted maximum flood water depth of the pond towards the south of the site is 0.15-0.3m and maximum velocities are 0.00-0.25m/s. This forms a maximum hazard of 'caution' in this area. Maximum flood depths during the 1% AEP event are 0.3-0.6m at the pond near the southern site boundary. Maximum velocities are 0.5-1.0m/s at the northwest corner of the site. The resulting hazard is 'danger for most' at the pond towards the south of the site. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |
| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The western three quarters of the site has a ≥25-50% susceptibility to groundwater flood emergence.<br>• The very eastern quarter of the site has a < 25% susceptibility to groundwater flood emergence.<br>This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located within a postcode where there have been 8 recorded historic sewer flooding incidences. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | The site is protected from flooding by high ground on either side of the Hempnall Beck south of the site. The upstream reach of the Hempnall Beck is not protected by any formal flood defences. |
| **Residual risk** | There is a residual risk to the south of the site if floodwater overtops the high ground adjacent to the Hempnall Beck. In such an event, the southern half of the site is likely to become inundated with floodwater due to the low-lying topography. |
| **Emergency planning** | |
| **Flood warning** | The site is not located in an Environment Agency Flood Warning Area. |
| **Access and egress** | An unnamed road-access path, leading from The Street, provides direct access from the south of the site to the western edge and centre. The east of the site can also be accessed from grounds of the Hempnall Primary School.<br>The site remains accessible by emergency vehicles along the road-access path leading through the site during the 1% AEP event. Access via the school grounds is still possible during this event. However, safe access and egress is impeded during the 0.1% AEP event in which the region to the south of the site has a maximum hazard of 'danger for most'. The large surface water pond at the south of the site crosses over the road access path and partially blocks access via the school grounds. Access may |

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| | still be possible by emergency vehicle via the school grounds but this should be further investigated at site-specific FRA stage. |
| **Dry Island** | The site is not located on a dry island. |
| **Climate change** | |
| **Implications for the site** | • Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.<br>• The predicted present day 0.1% AEP surface water flooding extent provides an indication of the likely increase in extent of the more frequent surface water events. There is a significant increase in the extent of surface water flooding between the 1% and 0.1% AEP event, suggesting the site is very sensitive to increased runoff as a result of climate change. This would require a detailed Flood Risk Assessment (FRA) to assess the site layout and design. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition.<br>• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling.<br>• Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.<br>• A site-specific FRA, with the most up-do-date climate change allowances, should be undertaken to investigate the implications of climate change on the site. |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br>• Geology at the site consists of:<br>  ○ Bedrock- Norwich Crag Formation.<br>  ○ Superficial- Leet Hill Sand and Gravel Member- Sand and Gravel.<br>• Soils at the site consist of:<br>  ○ Slightly acid loamy and clayey soils with impeded drainage<br>**SuDS**<br>• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.<br>• BGS data indicates that the underlying geology is a combination of sands and mud which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.<br>• The site is not located within a historic landfill site.<br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. |

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| | • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |
| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.<br>• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.<br>• Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.<br>• Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.<br>• The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows. |
| **NPPF and planning implications** | |
| **Exception Test requirements** | The Local Authority will need to confirm that the sequential test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.<br>The entire site lies outside of Flood Zone 2 and 3 but as it is predicted to be affected by surface water the Exception Test applies. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br>• Whilst the site lies entirely outside of Flood Zones 2 and 3, it is recommended that a site-specific Flood Risk Assessment is undertaken to provide evidence that the proposals satisfy the Exception Test due to surface water ponding within the site.<br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; the Joint Core Strategy as part of the Greater Norwich Development Partnership for Broadland, Norwich and South Norwich; and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.<br>• Consultation with the Local Authority and the Lead Local Flood Authority should be undertaken at an early stage.<br>**Guidance for site design and making development safe:**<br>• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).<br>• Development should be steered away from the south of the site where surface water ponding occurs. Ideally, this area will be preserved as green infrastructure.<br>• Safe access and egress will need to be demonstrated in the 0.1% AEP event plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should particularly be given to the siting of access points with respect to areas of surface water flood risk. |

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| | • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.<br>• Surface water should be discharged at the pre-development (greenfield) runoff rate which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. An integrated flood risk management and sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.<br>• Developers should refer to Norfolk County Council's 'Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning Guidance Document' and the Level 1 SFRA for information on SuDS for guidance on the information required by the LLFA from applicants to enable it to provide responses to planning applications. |

## Key messages

The development is likely to be able to proceed if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development to be steered away from low-lying region at the south of the site, if possible.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future, and that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties. Consideration to the implications of climate change should be given in this assessment.
- A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA or Anglian Water).
- Access and egress is not safely during the 0.1% AEP event due to surface water ponding along the road access path. A Flood Warning and Evacuation Plan should therefore be prepared for this site for both present day and considering climate change allowances. Consideration should be given to the siting of safe access and egress routes, and these must not impede surface water flows risk.

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. |
| **Climate change** | No modelled climate change data was available for this site. The 0.1% AEP event surface water mapping from the Risk of Flooding from Surface Water map has been used as a proxy for the impacts of climate change on surface water. |
| **Surface Water** | The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding. |
| **Surface water depth, velocity and hazard mapping** | The surface water depth, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping. |

| South Norfolk Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables |  |
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| **Site details** | |
| **Site Code** | **SN2118** |
| **Address** | Sneath Road, Sneath Common, TM 15544 89271 |
| **Area** | 0.54ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |
| **Sources of flood risk** | |
| **Location of the site within the catchment** | The site is located within the River Tas catchment. The River Tas flows north from its source, near Carleton Fen, and through Long Stratton before joining the River Yare at Trowse. The River Yare then continues eastwards until it reaches the North Sea at Great Yarmouth. |
| **Existing drainage features** | The site is located approximately 2.4km south of the River Tas, an ordinary watercourse. The Environment Agency states that this 16.7km river is not heavily modified. Online imagery suggests there are also a number of drainage ditches in the area. Local topography shows the site at a higher relief compared to land located further north, this indicates that drainage from the site would be in a northerly direction. |
| **Fluvial** | **The proportion of site at risk:**<br>**FZ3b –** 0%<br>**FZ3a –** 0%<br>**FZ2 –** 0%<br>**FZ1 –** 100%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br><br>**Available data:**<br>The Environment Agency's Flood Zone mapping has been used in this assessment.<br><br>**Flood characteristics:**<br>The site is not currently at risk of flooding from fluvial sources. The Environment Agency's Flood Mapping for Rivers and Sea does not show the site to be within flood zone 2 or 3 and there are no other watercourses in the vicinity of the site which are likely to pose a risk to the site. |
| **Coastal and Tidal** | The site is not a risk from coastal or tidal flooding. |
| **Surface Water** | **Proportion of site at risk (RoFfSW):**<br>**3.3% AEP** – 0%<br>Max depth – 0m<br>Max velocity – 0m<br>**1% AEP** – 0%<br>Max depth – 0m<br>Max velocity – 0m<br>**0.1% AEP** – 42%<br>Max depth – 0.30m<br>Max velocity – 1m/s |

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| | *The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)*<br><br>**Description of surface water flow paths:**<br><br>During the 3.3% AEP event, there is no surface water flooding predicted within the proposed site. There is a small ponding of surface water at the junction between Sneath and Plantation Road, but the depth of this flooding is modelled to be at maximum 0.15m. Maximum velocities are shown to be 1m/s. Safe access and egress to the site will therefore not be affected.<br><br>During the 1% AEP event, there is no surface water flooding predicted within the proposed site. The ponding shown in the 3.3% event extends further down Plantation Road and back into Sneath Road, however, this flooding depth will only be 0.30m at maximum. Therefore, emergency vehicles will still be able to access the site via these roads. Maximum velocities are shown to be 1m/s.<br><br>In event of a 0.1% AEP flood, there is significant surface water pooling predicted within the site. There is also a surface water flow path along the northern boundary of the site, which extends down Plantation Road, along the site's western boundary. Local LiDAR data indicates that this flow path flows northwards. The pooling within the site has a maximum flood depth of 0.30m and a maximum velocity of 1m/s. The same maximum depths are present for the surface water flow path, however the maximum velocity is 2m/s..<br><br>Flooding in all scenarios is classified as 'Very Low Hazard'. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |
| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The entire site has a <25% susceptibility to groundwater flood emergence.<br>This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located within a postcode shown to have 5 recorded instances of sewer flooding in the past. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | This site is not protected by any formal flood defences. |
| **Residual risk** | There is no residual risk to the site from flood risk management structures. |
| **Emergency planning** | |
| **Flood warning** | The site is not located in an Environment Agency Flood Warning Area. |
| **Access and egress** | The site is currently accessible from Sneath and Plantation Road. The site is likely to remain accessible in all modelled flood scenarios as flood depths are shown to be 0.30m at maximum, with a maximum hazard of 'Very Low'. Therefore, emergency vehicles will be able to have safe access and egress to the site.<br>The depths, velocities, hazards, durations and speeds of onset of surface water along access/egress routes should be investigated further in a site-specific assessment, to confirm whether access for emergency vehicles could still be obtained.<br>As surface water events are typically flashy and short-lived, it is likely that access to the site will only be affected for a short period of time. |
| **Dry Islands** | The site is not located on a dry island. |
| **Climate change** | |
| **Implications for the site** | • The present day 0.1% AEP surface water flooding extent provides an indication of the likely increase in extent of the more frequent surface water events. There is a significant increase in the extent of flooding on site between the 1% and 0.1% AEP surface water events, |

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| | indicating the site is very sensitive to the effects of climate change. This would require a detailed Flood Risk Assessment to assess the site layout and design. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition.<br>• Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific Flood Risk Assessment.<br>• The nearest watercourse to the site is approximately 300m to the north. As the site is significantly elevated above the site, it is very unlikely that the site will be at increased risk of fluvial flooding in future. . |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br>• Geology at the site consists of:<br>  ○ Bedrock- Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (undifferentiated) – Chalk.<br>  ○ Superficial- Lowestoft Formation - Diamicton.<br>• Soils at the site consist of:<br>  ○ Loamy and clayey soils- moderate fertility, impeded drainage.<br>**SuDS**<br>• The site is considered to have very low susceptibility to groundwater flooding, this should be confirmed through additional site investigation work. Below ground development such as basements may still be susceptible to groundwater flooding.<br>• BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.<br>• The site is not located within a historic landfill site.<br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.<br>• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |
| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.<br>• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.<br>• Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered.<br>• Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.<br>• Opportunities to incorporate source control techniques such as green roofs, blue/green corridors, permeable surfaces and rainwater harvesting must be considered in the design of the site.<br>• The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows. |
| **NPPF and planning implications** | |

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| **Exception Test requirements** | The Local Authority will need to confirm that the sequential test has been carried out. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'.<br><br>As the site is in Flood Zone 1 but affected by surface water flood risk the Exception Test is required. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br><br>• Although the site is not located in a Flood Zone, a large proportion of the site is subject to surface water flooding in event of a 0.1% AEP. Therefore, it is recommended that a precautionary approach is taken, and a site-specific flood risk assessment undertaken, including an assessment of future surface water flood risk accounting for climate change.<br><br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance, Norwich City Council's Local Plan policies, and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.<br><br>• Consultation with the Local Authority, Lead Local Flood Authority and the Environment Agency should be undertaken at an early stage.<br><br>**Guidance for site design and making development safe:**<br><br>• The development should be designed using a sequential approach.<br><br>• Safe access and egress will need to be demonstrated in the 0.1% AEP plus climate change rainfall event, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.<br><br>• The risk from surface water flow routes should be quantified as part of a site-specific Flood Risk Assessment, including a drainage strategy, to ensure that runoff from the development is not increased by placing development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond the current greenfield rates.<br><br>• It is recommended that finished floor levels are raised to 300mm above ground level to prevent surface water flooding within the site. Raising Finished Floor Levels may remove the need for resilience measures.<br><br>• On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment.<br><br>• New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. Assessment for runoff should include allowance for climate change effects.<br><br>• Surface water runoff should be fully attenuated to the greenfield rate to ensure that there is no increase in surface water flood risk elsewhere.<br><br>• Developers should refer to Norfolk County Council's 'Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning Guidance Document' and the Level 1 SFRA for information on SuDS for guidance on the information required by the LLFA from applicants to enable it to provide responses to planning applications. |

## Key messages

The development is likely to be able to proceed if:

- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future as a result of climate change, and that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- Finished floor levels are raised by 300mm above the design flood event to prevent surface water flooding on site.
- The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate.
- A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.
- Safe access and egress routes must not be in the areas of high surface water risk.

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping |

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| **Climate change** | No modelled climate change data was available for this site. The 0.1% AEP surface water mapping from the Risk of Flooding from Surface Water map has been used as a proxy for the impacts of climate change on surface water. |
| **Surface Water** | The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding. |
| **Surface water depth, velocity and hazard mapping** | The surface water depth, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping. |

# South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

## Site details

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| **Site Code** | **SN2183** |
| **Address** | Wymondham Road, Wreningham, Hethel, South Norfolk TM 15529 98583 |
| **Area** | 1.23ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |

## Sources of flood risk

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| **Location of the site within the catchment** | The site lies within the River Yare catchment. The eastern edge of the site is adjacent to an unnamed watercourse. This meets the confluence of an unnamed tributary of the River Tas 300m south of the site. The northeast-southwest trending unnamed tributary meets the River Tas 4.5km southeast of the site. |
| **Existing drainage features** | Land at the site slopes down towards the east, as seen by local topography. This indicates drainage is in a west-east direction, towards the unnamed watercourse along the eastern site boundary. |
| **Fluvial** | **The proportion of site at risk:**<br>**FZ3b –** 0%<br>**FZ3a –** 0%<br>**FZ2 –** 0%<br>**FZ1 –** 100%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br><br>**Available data:**<br>The Environment Agency's (EA) Flood Maps for Planning have been used within this assessment.<br><br>**Flood characteristics:**<br>The site is not shown to be at risk of fluvial flooding which show the site is not located within Flood Zone 2 and 3, however the Environment Agency data does not cover watercourses with a catchment of less than 1km$^2$ and the site is very likely to be at risk of fluvial flooding from the unnamed watercourse on the eastern boundary. The Risk of Flooding from Surface Water (RoFfSW) gives an indication of the risk from smaller watercourses, and this is discussed below.<br>It is recommended that detailed modelling is undertaken of the unnamed watercourse, including depth, velocity, and hazard outputs, to assess the risk to the site as part of a site-specific Flood Risk Assessment. |
| **Coastal and Tidal** | The site is not at risk of tidal or coastal flooding. |
| **Surface Water** | **Proportion of site at risk (RoFfSW):**<br>**3.3% AEP** – 45%<br>Max depth- 0.3-0.6m<br>Max velocity- 0.5-1.0m/s |

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| | **1% AEP** – 54%<br>Max depth- 0.3-0.6m<br>Max velocity- 0.5-1.0m/s<br>**0.1% AEP** – 69%<br>Max depth- 0.6-0.9m<br>Max velocity- 1.0-2.0m/s<br><br>*The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)*<br><br>**Description of surface water flow paths:**<br><br>The site is shown to be at significant risk of surface water flooding in all modelled events. Flows are in a northwest-southeast direction across the north and east of the site, associated with the unnamed watercourse on the eastern boundary. Surface water flooding occurs in the 3.3%, 1% and 0.1% AEP events, extending 50, 55 and 67m in from the eastern edge of the site respectively. During the 0.1% AEP event, surface water flow paths cover approximately two thirds of the site. Surface water flooding is confined to the east of the site due to its shallower topography.<br><br>During both the 3.3% and 1% AEP events, maximum flood depths are 0.3-0.6m and maximum velocities are 0.5-1.0m/s. This forms a maximum hazard of 'Danger for Most' in both events along the eastern edge of the site. During the 0.1% AEP event, surface water flood depths reach a maximum of 0.6-0.9m and maximum velocities are 1.0-2.0m/s. This correlates to a maximum hazard of 'Danger for Most' across the eastern half of the site.<br><br>Due to significant surface water flood depths and velocities, it is advised that a detailed site-specific FRA is undertaken for this site in order to fully evaluate surface water risk. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |
| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The entire site has a < 25% susceptibility to groundwater flood emergence.<br>This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located within a postcode where there have been 2 recorded historic sewer flooding incidences. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | The site is not protected by any formal flood defences. |
| **Residual risk** | The unnamed watercourse running along the eastern edge of the site is culverted under Ashwellthorpe Road 100m east of the site. This poses a residual risk to the site since if this culvert were to become blocked, water could back up and encroach onto the site. This would particularly impact the east of the site due to its proximity to the unnamed watercourse and shallow topography. The watercourse is also culverted under the same road 460m south of the site, which could also be of residual risk to the site in the event of a blockage. |
| **Emergency planning** | |
| **Flood warning** | The site is not located in an Environment Agency Flood Warning Area. |
| **Access and egress** | A heavy metal field gate leading from Wymondham Road provides direct access to the north of the site. The unnamed road leading from Ashwellthorpe Road next to 'Wreningham Stables Dressage' could provide access by emergency vehicles to the south of the site. |

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| | Due to the extensive surface water flows across the north and east of the site, access from the gate at Wymondham Road is likely to be significantly impacted during the 3.3%, 1% and 0.1% AEP events. The access point has a hazard of 'danger for most' during the 0.1% AEP event. Any access via Ashwellthorpe road is also likely to be significantly impacted during all events, with depths of 0.3-0.6m present in the 0.1% AEP surface water event. Access may still be possible during the 3.3% and 1% AEP events where depths and velocities are lower. Developers will need to demonstrate safe access and egress during the 0.1% AEP event and raising of access routes must not impeded surface water flows. Since safe access and egress to the site is likely to be impeded in all surface water flood events, a Flood Warning and Evacuation Plan should be prepared for the site, including considering a policy of shelter in situ, which may or may not be appropriate depending on the extent and durations of flooding indicated by detailed modelling. |
| **Dry Island** | The site is not located on a dry island. |
| **Climate change** | |
| **Implications for the site** | • Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.<br>• The present day 0.1% AEP surface water flooding extent provides an indication of the likely increase in extent of the more frequent surface water events. There is a significant increase in the extent of flooding on site between the 1% and 0.1% AEP event, suggesting that the site is sensitive to effects of climate change.This would require a detailed Flood Risk Assessment (FRA) to assess the site layout and design.<br>• The site is likely to be at risk from the unnamed watercourse on the eastern boundary and detailed modelling, applying the latest climate change allowances, should be undertaken as part of a site-specific FRA.<br>• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling.<br>• Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.<br>• A site-specific FRA, with the most up-do-date climate change allowances, should be undertaken to investigate the implications of climate change on the site. |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br>• Geology at the site consists of:<br>  ○ Bedrock- Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver, Chalk Formation and Portsmouth Chalk Formation.<br>  ○ Superficial- Lowestoft Formation- Diamicton.<br>• Soils at the site consist of:<br>  ○ Slightly acid loamy and clayey soils with impeded drainage.<br>**SuDS**<br>• The site is considered to have very low susceptibility to groundwater flooding, this should be confirmed through additional site investigation work. Below ground development such as basements may still be susceptible to groundwater flooding.<br>• BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.<br>• The site is not located within a historic landfill site.<br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the |

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| | permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3%, 1% and 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.<br>• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |
| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.<br>• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.<br>• Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.<br>• Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.<br>• The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows. |
| **NPPF and planning implications** | |
| **Exception Test requirements** | The Local Authority will need to confirm that the sequential test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.<br>Since the entire site lies outside of Flood Zone 2 and 3 the Exception Test is not required. Whilst the Exception Test is not required, available surface water mapping suggests that the majority of the site is at a significant risk of flooding from the watercourse on the eastern boundary which should be considered carefully when deciding whether to bring the site forward.<br>The Exception Test is needed if:<br>• 'More Vulnerable' and 'Essential Infrastructure' development is located within Flood Zone 3a and 'Highly Vulnerable' development is located within Flood Zone 2.<br>• 'Highly Vulnerable' infrastructure should not be permitted within Flood Zone 3a and Flood Zone 3b.<br>• 'More Vulnerable' and 'Less Vulnerable' infrastructure should not be permitted within Flood Zone 3b. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br>• Whilst the site lies entirely outside of Flood Zones 2 and 3, it is recommended that a site-specific Flood Risk Assessment is undertaken due to the significant surface water flow path across the site.<br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; the Joint Core Strategy as part of the Greater Norwich Development Partnership for Broadland, Norwich and South Norwich; and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document. |

- The unnamed watercourse on the eastern boundary should be modelled as part of the site-specific FRA, including depth, velocity, and hazard outputs. Modelling should include the latest climate allowances.
- Consultation with the Local Authority and the Lead Local Flood Authority should be undertaken at an early stage.

**Guidance for site design and making development safe:**

- The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
- The development should be designed using a sequential approach. Development should be steered away from areas of flood risk along the north and east of the site, preserving these spaces as green infrastructure. This is likely to significantly limit the area available for development.
- Safe access and egress will need to be demonstrated in the 0.1% AEP event plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. Due to the significant surface water flood risk posed to the site, a Flood Warning and Evacuation Plan must be prepared, including an assessment of the suitability of a shelter in situ policy using model outputs.
- Flood resilience and resistance measures should be implemented wherever possible during the construction phase, e.g. raising of floor levels and use of boundary walls.
- The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.
- On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment.
- Surface water should be discharged at the pre-development (greenfield) runoff rate which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. An integrated flood risk management and sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.
- Developers should refer to Norfolk County Council's 'Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning Guidance Document' and the Level 1 SFRA for information on SuDS for guidance on the information required by the LLFA from applicants to enable it to provide responses to planning applications.

## Key messages

The site is at considerable risk from fluvial/surface water flooding associated with the unnamed watercourse on the eastern boundary of the site, which is likely to severely limit the area available for development. Development is likely to be able to proceed if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development to be steered away from the north and east of the site.
- Where development is proposed within areas of risk, habitable floor levels should be above the fluvial design flood event (1% AEP) taking into account climate change. This level should be situated 300mm above the design flood level. Ground floor dwelling should be avoided where possible and waterproofing techniques should be used where necessary.

- A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA or Anglian Water).
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future as a result of climate change, and that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- If flood mitigation measures are implemented, they should be tested to ensure water is not displaced elsewhere.
- Safe access and egress is likely to be impacted during the 3.3%, 1% and 0.1% AEP events. Therefore, a Flood Warning and Evacuation Plan should be prepared for this site for both present day and considering climate change allowances. Consideration should be given to the siting of safe access and egress routes, and these must not impede surface water flows risk.

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. |
| **Climate change** | No modelled climate change data was available for this site. The 0.1% AEP event surface water mapping from the Risk of Flooding from Surface Water map has been used as a proxy for the impacts of climate change on surface water. |
| **Fluvial depth, velocity and hazard mapping** | No fluvial modelling is available for the unnamed watercourse on the eastern boundary of the site. The Environment Agency's Risk of Flooding from Surface Water map has been used to give an indication of the likely flood extents from this watercourse. |
| **Surface Water** | The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding. |
| **Surface water depth, velocity and hazard mapping** | The surface water depth, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping. |

# South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

## Site details

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| **Site Code** | **SN4069SL** |
| **Address** | White House Farm, Scole Road, Brockdish, South Norfolk/ NGR TM 21164 79531 |
| **Area** | 0.172ha |
| **Current land use** | Greenfield |
| **Proposed land use** | Residential |

## Sources of flood risk

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| **Location of the site within the catchment** | The site is located in the catchment of the River Waveney, approximately 3km downstream of the confluence with the River Dove. The River Waveney flows from its source in the Regrave and Lopham Fen National Nature Reserve, through the towns of Harleston, Diss, Bungay and Beccles, and joins the River Yare before it reaches the sea at Great Yarmouth. |
| **Existing drainage features** | The site is located approximately 300m north of the River Waveney. A number of small channels drain the fields to the south of the site into the River Waveney. There are no other drainage features in the vicinity of the site. |
| **Fluvial** | **The proportion of site at risk:**<br>**FZ3 –** 0%<br>**FZ2 –** 0%<br>**FZ1 –** 100%<br><br>*The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).*<br><br>**Available data:**<br>Site-specific 2d modelling has been undertaken for the site in 2022 using TUFLOW, based on the existing Environment Agency Lower Waveney model, 2013; as rerun in 2017 by JBA Consulting.<br><br>**Flood characteristics:**<br>The site is not located within Flood Zone 2, however is directly adjacent to Flood Zone 2 on the southern border. Flood zones at this location are based on 1d modelling and high-level 2d modelling has been undertaken to inform the risk to the site in this assessment.<br>2d modelling suggests the site is not at risk during the 0.1% AEP event, although flooding reaches the southern border of the site. |
| **Coastal and Tidal** | The site is not at risk from coastal or tidal flooding. |
| **Surface Water** | **Proportion of site at risk (RoFfSW):**<br>**3.3% AEP** – 0%<br>Max depth -<br>Max velocity -<br>**1% AEP** – <1%<br>Max depth<br>Max velocity |

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| | **0.1% AEP** – <1%<br>Max depth<br>Max velocity<br><br>*The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)*<br><br>**Description of surface water flow paths:**<br><br>The site is not predicted to be at risk of surface water flooding in the 0.1% AEP event, however surface water flows are present along Scole road to the north of the site and Syleham road to the east.<br>In the 3.3% AEP event, depths along Scole Road and Syleham are below 0.3m, with velocities below 0.25m/s. In the 1% AEP event, extent increases slightly with depths remaining below 0.3m on Scole Road, 0.3-0.6m on Syleham Road. Velocities reach up to 1.0-2.0m/s.<br>In the 0.1% AEP event, the surface water extent increases significantly, surrounding the site on three sides (north, east and south). Depths are greatest to the east along Syleham Road, up to 0.6-0.9m, and are mostly below 0.3m in the direct vicinity of the site. Velocities are mostly between 1.0-2.0m/s, with a hazard rating of 'danger for most' across most of the flooded area. |
| **Reservoir** | The site is not shown to be at risk of reservoir flooding from the available online maps. |
| **Groundwater** | The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk:<br>• The entire site has a >= 25% <=50% susceptibility to groundwater flood emergence.<br>This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage. |
| **Sewers** | The site is located in a postcode with no recorded historic sewer flooding. |
| **Flood history** | The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. |
| **Flood risk management infrastructure** | |
| **Defences** | This site is not protected by any formal flood defences. |
| **Residual risk** | There is no residual risk to the site from flood risk management structures. |
| **Emergency planning** | |
| **Flood warning** | The site is not located within an Environment Agency Flood Warning or Alert area. |
| **Access and egress** | Access to the site is via Scole Road, to the north. Access/egress is unlikely to be affected by flooding in the 0.1% AEP fluvial event.<br>Surface water flows are likely to significantly impede access to the site during the 1% and 0.1% AEP surface water events. Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must not impact on surface water flow routes.<br>Consideration should be given to the siting of access points with respect to areas of surface water flood risk. A Flood Warning and Evacuation plan should be in place for the site. Alternatively, risk could be managed by inclusion of a higher refuge and a flood response plan that meets the requirements of the Local Council and their Emergency Planner. |
| **Climate change** | |

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| **Implications for the site** | • Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.<br>• The central and higher climate change scenarios have been modelled as part of this assessment. Modelling suggests that the site will not be at risk in the future even during the 0.1% AEP event in the higher central scenario.<br>• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% event mapping suggests that the site is unlikely to be at increased risk of surface water flooding in future, although there remains a significant risk to the area around the site. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition.<br>• Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA. |
| **Requirements for drainage control and impact mitigation** | |
| **Broad-scale assessment of possible SuDS** | **Geology & Soils**<br>• Geology at the site consists of:<br>  ○ Bedrock- Norwich Crag Formation- Sand.<br>  ○ Superficial- River Terrace Deposits, 1 to 2- Sand and Gravel.<br>• Soils at the site consist of:<br>  ○ Lime-rich loamy and clayey soils with impeded drainage.<br>**SuDS**<br>• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.<br>• BGS data indicates that the underlying geology is sand which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.<br>• The site is not located within a historic landfill site.<br>• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.<br>• The site is within the Waveney, Lower Yare & Lothingland Internal Drainage Board district who may have additional requirements regarding discharge rates (directly or indirectly) into their district. The IDB should be consulted during the detailed design of the site to establish the Board's requirements, and determine whether there will be a need to apply for surface water discharge or ordinary watercourse consents.<br>• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.<br>• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. |

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| **Opportunities for wider sustainability benefits and integrated flood risk management** | • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.<br>• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.<br>• Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. |
| **NPPF and planning implications** | |
| **Exception Test requirements** | The Local Authority will need to confirm that the sequential test has been carried out. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'.<br>As the site is located entirely within Flood Zone 1, the Exception Test is not required for the site. |
| **Requirements and guidance for site-specific Flood Risk Assessment** | **Flood Risk Assessment:**<br>• At the planning application stage, a site-specific Flood Risk Assessment is not required as the proposed development site is located in Flood Zone 1, however given the significant surface water flows in the vicinity of the site is recommended that a precautionary approach is taken and a Sirte specific Flood Risk Assessment is undertaken.<br>• All sources of flooding, particularly the risk of fluvial and surface water should be considered as part of a site-specific flood risk assessment.<br>• The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance, Norwich City Council's Local Plan policies, and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document.<br>• Consultation with the Local Authority, Lead Local Flood Authority and the Environment Agency should be undertaken at an early stage.<br>• The development should be designed to ensure that mitigation measures are in place to ensure the development does not flood, or that ground level space is used for less vulnerable parts of the development.<br>**Guidance for site design and making development safe:**<br>• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).<br>• Safe access and egress will need to be demonstrated in the 1% AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.<br>• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.<br>• Areas at risk from surface water flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. Integrated flood risk management |

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| | and sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.<br><br>• The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water). |

## Key messages

The development is likely to be able to proceed if:

- Safe access and egress can be demonstrated in the 1% AEP surface water even, or risk is managed by inclusion of a higher refuge and a flood response plan that meets the requirements of the Local Council and their Emergency Planner.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water).

## Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning.

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| **Flood Zones** | Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. |
| **Climate change** | Climate change allowances (for the 2080s) were modelled as part of Level 2 SFRA. This included Central (+11%), Higher central (+20%) |
| **Fluvial depth, velocity and hazard mapping** | Site-specific 2d modelling has been undertaken for the site in 2022 using TUFLOW, based on the existing Environment Agency Lower Waveney model, 2013; as rerun in 2017 by JBA Consulting. |
| **Surface Water** | The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding. |
| **Surface water depth, velocity and hazard mapping** | The surface water depth and hazard mapping for the 1 in 1% AEP event is taken Environment Agency's Risk of Flooding from Surface Water mapping. |